Sand Hollow Containment Efforts
May – September, 2010

11/9/2010

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Report Summary

The following is a summary of data presented in this report.

Sampling/Monitoring

- No additional mussels have been found since the initial finding on May 21, 2010.

Watercraft Totals

- Total Watercraft Contacted - 9,296
  - Ski – 5,156
  - Fish – 2,002
  - Personal Water Craft (PWC) – 2,073
  - Other – 62

- Self Decontamination – 4,832 (52%)

- Professional Decontamination – 4,464 (48%)

- Weekday use – 5,235 (average - 57 boats/day)

- Weekend use – 4061 (average - 98 boats/day)

- Top ten list of previous waters boated
  - Sand Hollow – 78%
  - Quail Lake – 5%
  - Lake Powell – 4%
  - Unknown – 3%
  - Utah Lake – 2%
  - Lake Mead – 1%
  - Gunlock Reservoir - <1%
  - Deer Creek Reservoir - <1%
  - Panguitch Lake - <1%
  - Jordanelle Reservoir - <1%

Staffing/Personnel Needs

- Current operations for the period June-September required the equivalent of 5 Full Time Employees (FTE) of Aquatic Invasive Specie (AIS) technician/seasonal time (2 of which were Volunteer).
  - June – 3,008 hours
  - July – 2,856 hours
  - August – 2,848 hours
  - September – 1,120 hours
  - Volunteers accounted for 40% of the total work force at Sand Hollow Reservoir.

Budget

- $96,211 Spent at Sand Hollow July 1 through October 15, 2010 (FY11)
- $35,539 Spent at Other Regional Waters July 1 through October 15, 2010 (FY11)

Law Enforcement

- Contacts- 420
    - This represents 17.8% of the total AIS contacts in the Southern Region.
- License Checks- 189
    - This represents 11.8% of the total AIS license checks in the Southern Region.
- Enforcement Time- 203 hr. 36 min.
    - This represents 23% of the total law enforcement time devoted to AIS (more than any other fishery in the Southern Region).
- The Zion Conservation Officer District (Sand Hollow Reservoir, Quail Creek Reservoir, and Kolob Reservoir) constitutes over 1/3 of the total AIS law enforcement time in the Southern Region (more than any other district).

Outreach

- Newspaper Articles – 3
- Radio spots –Aired 10 times on 3 stations (total of 90 airings)
- Videos 2 – "What is going on at Sand Hollow", and "How to self-decontaminate your boat" As of November 8, 2010 the videos had been viewed 150 times on youtube.com
- "The Wild Side" weekly radio show on KSUB, a St. George/Cedar City radio station, discussed AIS/Sand Hollow regularly throughout the summer.

Introduction

Dreissena mussels (Quagga and Zebra) are an aquatic invasive species that, due to their explosive, uncontrollable populations, have elicited national, regional, State of Utah, and local concerns relative to likely significant environmental and economical impacts. Quagga mussels were discovered in Lake Mead, Nevada during January 2007. Soon thereafter the Utah Department of Natural Resources began an assessment of threats to Utah by *Dreissenid* mussels, and put policy NR-07-D-11 into effect to prevent invasion of *Dreissenid* mussels into Utah's waters.

A single live adult Quagga mussel (*Dreissena bugensis*) was discovered in Sand Hollow Reservoir on May 21, 2010. Routine monitoring (e.g., plankton samples for veligers, artificial substrate samplers, scuba dive inspections and shoreline searches) for Quagga mussel veligers by Utah Division of Wildlife Resources (UDWR) and the Washington County Water Conservancy District (WCWCD) during 2008 and 2009 showed no previous evidence for the mussels. Sand Hollow Reservoir is a 1,000 surface-acre reservoir located southwest of the City of Hurricane in Washington County, Utah (Figure 1). It is an off-stream impoundment with a maximum capacity of 50,000 acre-ft and receives water via a diversion from the Virgin River, which also fills Quail Creek Reservoir. Quail Creek Reservoir (590 surface acres, maximum capacity of 40,325 acre-ft) is located approximately 3 miles north of Sand Hollow Reservoir, and impounds water from Quail Creek and Leeds Creek as well as from Virgin River. The two reservoirs are connected by a pipeline which allows water to be transferred back and forth (Figure 1). Both reservoirs are owned and operated by the WCWCD, which provides municipal, industrial and agricultural water within Washington County. Utah Division of State Parks and Recreation (UDSPR) operate a state park, encompassing Sand Hollow Reservoir and surrounding lands under agreement with the water conservancy district. UDWR is the state's wildlife authority and manages the bass/blue gill fishery resource within the reservoir. The reservoir and State Park are heavily used (approximately 20,000 boat launches per year) by local and nonresident recreational boaters and anglers.

This report summarizes containment efforts at Sand Hollow Reservoir by UDWR from May 21 through September 30, 2010. Containment efforts at Sand Hollow Reservoir were conducted under the initial Control Plan, Sand Hollow Reservoir, Guidance for Management of an Infestation of *Dreissena* mussels which was signed on June 16, 2010. A revised Control Plan has been drafted which will guide AIS control efforts at the reservoir in the future. An additional report has been drafted detailing interdiction/education efforts at other major waters in the Southern Region for the period of April 1 through September 30, 2010, including Sand Hollow Reservoir.

Results and Discussion

Sampling/Monitoring: Following the identification of Quagga mussel in Sand Hollow Reservoir, an aggressive sampling and monitoring program was established for Sand Hollow and Quail Creek reservoirs as part of the Control Plan. Three separate sampling techniques were conducted monthly at the two reservoirs: 1) plankton tows, 2) substrate

sampling, and 3) diving surveys. As of September 30, 2010 no additional *Dreissena* mussels have been identified in either reservoir or surrounding water bodies (Table 1).

The lack of documentation for additional veligers or adult Quagga mussels at Sand Hollow is perplexing. Given the elevated effort to find veligers and adults, the monitoring results suggest that the threat of moving mussels away from Sand Hollow is small at the current time. The threat of new mussels arriving at Sand Hollow from infested waters in Arizona and Nevada however is increasing with the spread of mussels in those states. With that in mind, interdiction may be just as or more important than containment.

Watercraft Decontamination: Efforts were made to survey and inform all water craft users entering Sand Hollow State Park concerning the mussel issue. A total of 9,296 users were contacted as they departed the reservoir. Additionally, users were asked to identify the last water body where their craft was used in an attempt to identify the most likely location or "home water" where the boat would be used next. The majority (78.0%) of users indicated that Sand Hollow was the last water body used (Figure 2), followed by Quail Creek Reservoir (4.5%), Lake Powell (3.7%), and Utah Lake (1.5%).

All users were informed of the decontamination requirements and alternatives under Utah Administrative Code R657-60-8 and the current Control Plan. Under that rule, all conveyances and equipment that have been in or on the water at Sand Hollow Reservoir, are subject to the provisions in Utah Code § 23-27-201. This means any boat, vessel, personal watercraft, motor vehicle, trailer, or other article capable of carrying or containing a Quagga mussel or water that exits Sand Hollow Reservoir must comply with decontamination requirements before transporting the conveyance or equipment or entering any other water body in the State of Utah. Nevertheless, under the Sand Hollow Control Plan, decontamination was not required when a conveyance or equipment is removed from Sand Hollow Reservoir and subsequently re-enters the reservoir, provided the conveyance or equipment is inspected, drained, and cleaned as required in Utah Admin. Code R657-60-5 and is not placed in or on any other water body in the interim without first being decontaminated.

Decontamination must be completed in one of two ways:

> Professional decontamination by using a professional decontamination service approved by the UDWR to apply scalding water (140 degrees Fahrenheit) to completely wash the equipment or conveyance and flush any areas where water is held, including ballast tanks, bilges, live-wells, and motors*; or
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> Self-decontamination by: 1) removing all plants, fish, mussels and mud from the conveyance or equipment; 2) draining all water from the equipment or conveyance, including water held in ballast tanks, bilges, live-wells, and motors; and 3) drying the equipment or conveyance for no less than 7 days in June, July and August; 18 days in September, October, November, March, April and May; 30 days in December, January and February; or expose the equipment or conveyance to sub-freezing temperatures for 72 consecutive hours.
>
> * The Sand Hollow Rapid Response Team initially determined that boat motors would not require a hot water flush as part of the Professional decontamination.

This was later (September) changed and it was determined that all boats requiring a professional decontamination would have the motor flushed as outlined above.

As watercraft departed the reservoir, a total of 4,832 or about 52% of users reported they would be returning to Sand Hollow without boating at other waters in the interim or they would not be boating prior to the date required for drying under the self-decontamination option (Table 2, Figure 3 and 4). Water craft belonging to operators that choose the opportunity to return to Sand Hollow without being decontaminated or that utilized the self-decontamination option were marked for easy identification. The tag used to mark those water craft includes information on decontamination requirements and were marked with the date when the watercraft met the requirement for drying under the self-decontamination option (Figure 5).

Approximately 48% of the total users at Sand Hollow or a total of 4,464 watercraft were professionally decontaminated by UDWR/UDSPR personnel. This action required extensive staffing and coordination with UDSPR. Staffing requirements during weekends included 4-5 UDWR employees and 4 dedicated hunters per day (Table 3). Peak use at the decontamination stations occurred daily between the hours of 7:30 and 9:00 p.m. (Figure 6). Weekend use accounted for approximately 44% of the use and a breakdown by month showed the heaviest use occurred during July, followed by June and August (Table 4). Adjustments were made throughout the summer to reduce staffing and streamline operations. The bottom line is we made every effort to decontaminate all boats identified as high risk and all boats requesting decontamination with little to no inconvenience to watercraft owners.

Budget: Beginning July 1, 2010 all costs associated with containment efforts at Sand Hollow were tracked separately from those associated with interdiction efforts at other waters. For the period of July 1 through October 15 the total cost of containment at Sand Hollow was $96,211, personnel services accounted for 85% of the total cost. The $96,211 was money spent in the E1A520XXX Program code, the Aquatics section AIS Program; it did not include costs associated with LE or other section assistance. This made up approximately 33% of the total AIS Budget in the aquatic section. Overall $144,781 was coded to AIS in the Southern Region, of that 63% was associated with containment efforts at Sand Hollow Reservoir (Figure 7).

Personnel: UDWR personnel conducted containment efforts at Sand Hollow daily between the hours of 10:00 a.m. and 10:00 p.m. UDSPR attempted to close the lake at 9:00 p.m. UDSPR personnel conducted containment efforts prior to 10:00 a.m. daily until UDWR personnel arrived. UDWR hired a total of seven seasonal employees to work containment efforts at Sand Hollow. Additionally, numerous full time employees and seasonal employees worked part time at Sand Hollow to ensure we adequately covered needs at Sand Hollow. UDSPR had one full time employee funded by UDWR, who conducted both containment and interdiction efforts at the reservoir. UDWR's Dedicated Hunter volunteers accounted for 40% of the total work force. The volunteer force used at Sand Hollow was essential to the success of the program; Dedicated

Hunters volunteered 3,920 hours, $2,450.00 worth of equipment, professional experience, and advice from diverse backgrounds.

Decontamination Site: Boat decontamination was conducted at three locations within the Sand Hollow Complex during 2010 (Figure 8). Site locations were adjusted to better facilitate park operations and reduce confusion of boaters leaving the park. Additionally, the south boat ramp was closed throughout the summer. By closing the south ramp we were able to reduce the number of UDWR employees. Additional signs were constructed and donated by Dedicated Hunter volunteers that also assisted with traffic control and reduced boater confusion.

Pressure Washers: A total of five pressure washers were required at Sand Hollow Reservoir during the summer months (May – August). Three new units were purchased, in June and put into operation the first part of July. Four pressure washers were used daily with one unit left in reserve in case of breakdowns. Break downs became less frequent as the summer progressed. Additionally, design modifications to the new units showed significant improvements. However, the new units do not have a means of controlling the temperature of water. The burner will heat the water entering the unit 110 to 120 degrees above ambient water temperature. The water entering the units from storage tanks oft times reached temperatures exceeding 90 degrees, thus water used to clean watercraft reached maximum temperatures exceeding 200 degrees.

The high temperature water from these new units has caused one injury and damage to two boats. A UDWR technician was burned when a quick connect attachment came apart, and hot water was able to get inside his glove. He was treated at a local hospital and returned to work two days later. Additionally, two claims were submitted to the State of Utah's Risk Management for damage to a boat's perfect pass system (a mileage calculator) and another boat's factory installed motor flush attachment. The thin plastic fins on the mileage calculator melted due to the heat from the pressure wash units and the flush attachment burst for unknown reasons.

We continue to have problems with specific attachments. The plunger, which is used to pump water into ballast tanks and engines, is not built to withstand the high pressure and heat. We are working with Hydro Engineering to remedy the problems, however a solution has not been found. When equipment fails, UDWR personnel credibility also fails. Most boat owners know that motors and pumps on their boats are not meant to be run out of water and are worried about burning out the impellers, bearings, etc. When the equipment fails to seal tightly (or fall off because of pressure) to the motor or boat hull or the unit completely fails to operate properly owners become apprehensive and in many cases do not want us to decontaminate engines/ballast tanks.

Ballast Tanks: With the increasing popularity of wakeboarding and other similar water sports, there has been a push to find ways of making the biggest wake possible. The easiest way for boater to increase the size of their wake is to simply displace more water by weighting down their boat. Wakeboarding ballast (boat ballast) come in several forms, but the two biggest are either lead or boat ballast bags that fill with water. Many of the new inboard wakeboard-specific boats these days come equipped standard with

built in automatic ballast tanks. Additionally, there are numerous aftermarket ballast options. Ballast tanks/bags are one of the biggest challenges we faced during decontamination operations. In numerous cases we were unable to flush these tanks with hot water. Additionally, boats with ballast tank took on average an additional 23 minutes to decontaminate.

Law Enforcement: In May, 2010 two separate incidents occurred at Sand Hollow State Park involving Quagga Mussels. UDWR Law Enforcement (LE) took the lead in both investigations and was greatly involved in subsequent containment efforts including increased patrols, public outreach efforts, and Rapid Response Team meetings. These activities were in cooperation with the ongoing efforts of DWR biologists, UDSPR and WCWCD.

Conservation Officer Mark Ekins was the primary investigating officer of the first incident which involved a Quagga mussel being found on a UDSPR boat in a maintenance garage. It was later confirmed through lab analysis that the Quagga mussel had been glued to the boat. Other officers who assisted included: Chris Schulze, Lt. Scott Dalebout, and USFWS Agent Bonnie Bell.

Conservation Officer Chris Schulze was the primary investigating officer of the second incident which confirmed the presence of Quagga mussel at Sand Hollow Reservoir and led to present containment efforts. Additionally, LE personnel assisted with: directing traffic, washing boats, conducting boater surveys, directing boats from the boat ramp to the washers, conducting routine self-certification checks (issuing citations/warnings as warranted), assisting UDWR AIS personnel, and interfacing with Sand Hollow users and the public at large. Lt. Scott Dalebout, Mark Ekins, Sgt. Brian Shearer, Josh Carver, Zed Broadhead, and Kody Jones have participated in containment efforts at Sand Hollow Reservoir.

At the request of Southern Regional Supervisor, Doug Messerly, and UDWR Assistant Director, Cindee Jensen, an investigation was launched with the purpose of determining any connection between the two Quagga mussel incidents (given the short, suspicious time frame in which both were discovered). Conservation Officer Schulze and Investigator Richard Ashcroft conducted this investigation.

LE reported contacting 420 boaters at Sand Hollow Reservoir, this accounted for 18% of the total LE contacts in the Southern Region. An additional, 189 license checks were conducted accounting for 12% of the regional total. In total LE spent 203 hours and 36 minutes devoted to AIS activities or 23% of their total time available at Sand Hollow Reservoir. This was more than any other water body in the Southern Region.

Outreach: UDWR's outreach personnel responded to the initial finding of Quagga mussel at Sand Hollow Reservoir and wrote and distributed the initial press release. Lynn Chamberlain, the Outreach Manager in the Southern Region, was a key participant on the response team providing valuable insight and guidance. In preparation for the Memorial Day weekend a 30 second radio add was produced and aired on 3 stations 10 times per day (total of 90 airings). Outreach responded to press inquiries daily for the

first week and as required thereafter. In early June, outreach provided information to the Spectrum for an article on Sand Hollow AIS and in August a third article was printed concerning the summers activities. Additionally, ongoing activities at Sand Hollow Reservoir were discussed continually throughout the summer on KSUB's weekly radio show "The Wild Side" which airs in the Cedar City and St. George area.

Two short videos were produced: 1) What is going on at Sand Hollow, and 2) How to self-decontaminate your boat. These videos have been uploaded to a popular internet site youtube.com and a link to this site is on the UDWR web page as of November 8, 2010 about 150 people had viewed the videos on youtube.com. Additionally, the videos will be used at Sand Hollow Reservoir's visitor center, WCWCD's lobby, and UDWR's offices statewide.

Outreach was an important component of the efforts conducted at Sand Hollow Reservoir this summer and will continue to play an important role as we adjust and streamline the process.

Recommendations

1. Continue to monitor Sand Hollow and Quail Creek reservoirs as outlined in the Control Plan. If results from future sampling show positive results, control and decontamination procedures should be evaluated and improved to deal with increased risk.
2. Encourage self-decontamination. Risk levels at Sand Hollow Reservoir appear to be low. Use the exit interviews as an opportunity to educate boaters and prepare them for increased levels of decontamination if risk levels increase.
3. Continue providing decontamination services at Sand Hollow Reservoir. Provide and discuss education materials with all boaters. Only provide decontamination certificates to those that have had a complete decontamination (including motors and ballast tanks).
4. Provide the best possible service to boaters. However, it may not be feasible to continue with the level of service provided thus far. Boaters will likely be inconvenienced during busy weekend/holiday periods, since it does take a few minutes to conduct professional decontaminations, when requested.
5. Continue to look for opportunities to streamline or adjust operations. Work with UDSPR and the WCWCD in developing a Memo of Understanding (MOU) with State Parks for future AIS management operations.
6. Continue to work closely with LE Officers at Sand Hollow Reservoir and other local waters. Officers are a great resource and are willing to help as required.
7. Utilize Outreach personnel to further instruct boaters on self-decontamination, encourage them to “clean, drain and dry” regardless of the water they are using. With future budget constraints likely, self-decontamination and education will have to be a focus of the AIS program in the Southern Region.

Lessons Learned

1. Upon initial discovery of *Dreissena* mussels or an aquatic invasive species that requires the establishment of a Control Plan as was required at Sand Hollow State Park, careful consideration should be given to a complete closure of the reservoir/lake until appropriate funding, resources, and man power have been identified and put in place to conduct a successful operation. This is a difficult decision but should be carefully considered. In our case operations were initiated immediately following discovery, we were severely understaffed and unprepared. A one or two week closure would have provided us the opportunity to have personnel and equipment ready to handle the operations.

2. Boat owners were warned and prepared for possible inconveniences due to decontamination procedures. However, we were able to complete all procedures and data collection with little to no inconvenience to boat owners. With budget short falls predicted in future months, boat owners will likely be faced with longer waits and possible boat use restrictions. Outreach is a key component in educating boaters prior to visiting Sand Hollow. It is very important to utilize all available outlets to educate these boaters and prepare them for likely delays and inconveniences they may face.

3. Maintaining pressure washers in good working order is extremely important. When pressure washers breakdown or malfunction during decontamination, boat owners become apprehensive and concerned with our abilities to properly decontaminate their boat without causing damage. Additionally, pressure wash units that are not functioning properly will not properly decontaminate a boat and could cause harm to the operator or watercraft.

Table 1. Sand Hollow and Quail Creek reservoirs--*Dreissena* mussel sampling Conducted during summer 2010.

Sand Hollow Reservoir

Date	Sampling Technique	Sampling By	Results
1/6/2010	Substrate Sampler	WCWCD	Negative
3/30/2010	Substrate Sampler	WCWCD	Negative
5/21/2010	Divers	WCWCD	Positive
5/23/2010	Substrate Sampler	WCWCD	Negative
5/25-26/2010	Dock Inspections	UDWR	Negative
6/6/2010	Plankton sample (pump)	UDWR	Negative
7/8/2010	Plankton Sample (vertical tow)	UDWR & WCWCD	Negative
8/4/2010	Substrate Sampler	WCWCD	Negative
9/1/2010	Plankton Sample (vertical tow)	UDWR & WCWCD	Negative
10/5/2010	Divers	WCWCD	Negative

Quail Creek Reservoir

Date	Sampling Technique	Sampling By	Finding
1/18/2010	Substrate Sampler	WCWCD	Negative
3/9/2010	Plankton Sample (vertical tow)	WCWCD	Negative
5/24/2010	Plankton Sample (vertical tow)	WCWCD	Negative
5/24/2010	Substrate Sampler	WCWCD	Negative
5/25/2010	Divers (boat ramps)	WCWCD	Negative
5/25/2010	Divers (Dam and Intake)	WCWCD	Negative
6/16/2010	Plankton Sample (vertical tow)	UDWR & WCWCD	Negative
7/13/2010	Plankton Sample (vertical tow)	UDWR & WCWCD	Negative
8/30/2010	Plankton Sample (vertical tow)	UDWR & WCWCD	Negative
9/27/2010	Plankton Sample (vertical tow)	UDWR & WCWCD	

Table 2. Disposition of watercraft departing Sand Hollow Reservoir, May 28 through September 30, 2010.

Month	Self Decontamination	Professional Wash	Total
May*	241	448	689
June	1,126	1,333	2,459
July	1,401	1,212	2,613
August	1,121	754	1,875
September	943	717	1,660
Total	4,832	4,464	9,296

* Data was collected for the period of May 28-31

Table 3. Staffing requirements at Sand Hollow Reservoir, May 28 through September 30, 2010. Reported as 8 hour Man-days.

Month	Paid Employees (man-days)	Volunteers (man-days)	Total (man-days)
May	22	0	22
June	201	175	376
July	217	140	357
August	181	175	356
September	140	0	140
Total	761	490	1,251
FTE's	3	2	5

Table 4. Weekend verse weekday use and disposition of watercraft at Sand Hollow Reservoir, May 28 through September 30, 2010.

Month	Weekday (m-f)			Weekend (sat, sun & holidays)		
	Self	Prof. Wash	Total	Self	Prof. Wash	Total
May	67	229	296	174	219	391
June	715	846	1,561	411	487	898
July	790	682	1,472	611	530	1,141
Aug	688	401	1,089	414	374	788
Sept	473	344	817	471	372	843
Total	2,733	2,502	5,235	2,081	1,982	4,061

Figure 1. Schematic of Quail Creek pipeline. The main pipeline was built in 1986 as part of the Quail Creek Reservoir system. Water is diverted from the Virgin River near Virgin and piped to Quail Creek Reservoir. In 2002 Sand Hollow Reservoir was constructed and tied into the Quail Creek system. A pipe extends from the Quail Hydro to Sand Hollow to deliver the water to the reservoir. Sand Hollow sits higher than Quail Creek Reservoir and requires a pumping station for a final lift into the reservoir. Sand Hollow Reservoir's primary purpose is not surface storage of water, but managed aquifer recharge to the underlying Navajo Sandstone Aquifer

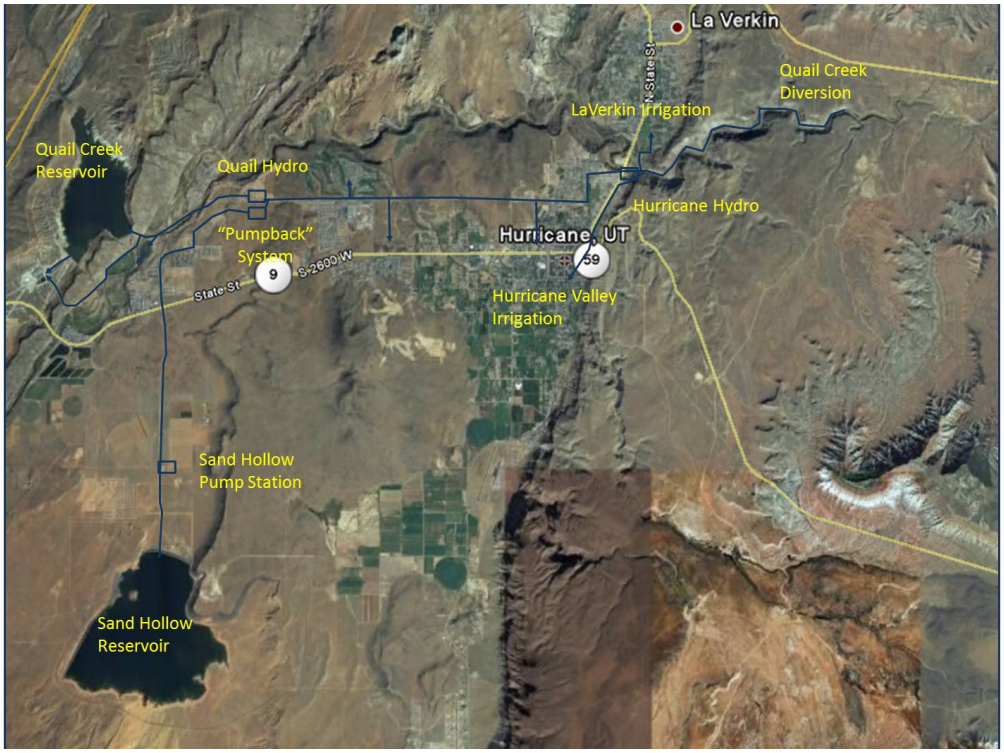

Figure 2. Last water body visited by boaters prior to coming to Sand Hollow Reservoir, May 28 through September 30, 2010.